DOCUMENT RESUME

ED 254 434 SO 016 154

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TITLE Developing Computer Literate Social Studies Teachers.
PUB DATE Nov 84
NOTE 28p.; Paper presented at the Annual Meeting of the National Council for the Social Studies (64th, Washington, DC, November 15-19, 1984).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Communication Skills; Computer Assisted Instruction; *Computer Literacy; Computer Managed Instruction; Computer Software; Concept Teaching; Data Interpretation; Data Processing; *Educational Needs; Elementary Secondary Education; *Futures (of Society); Information Sources; Instructional Materials; Microcomputers; Problem Solving; Skill Development; Social Change; Social History; *Social Studies; *Teacher Education

ABSTRACT

Six dimensions of computer literacy for social studies educators to address are discussed. In preparing social studies teachers for the 21st century, educators need to determine which aspects of computer literacy are essential to incorporate into teacher education. First, teachers must have knowledge of the basic sources of information, such as relevant periodicals. Second, teachers must understand the process of communicating with microcomputers. While teachers do not have to be programmers, they must have some first-hand experience in trying to communicate with computers in order to appreciate their limitations. Third, teachers need to know about hardware components. Fourth, teachers must know about available software and its compatibility with hardware. The fifth area in which teachers must be knowledgeable is in microcomputer applications in the social studies. Programs can help students learn data processing and interpretation, communication skills, group participation skills, facts, concepts, and problem solving. Teachers can also use computers in the management of classroom tasks. And, finally, teachers must know about the social implications of microcomputers. (RM)

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ED254434

"Developing Computer Literate Social Studies Teachers"

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Paper presented at the annual conference of the
National Council for the Social Studies
College/University Faculty Assembly November 15, 1984
Washington, DC

SO 016 154

Introduction

Unlike most other educational innovations, what has been characterized as the "micro revolution" has a good chance to survive, expand, and dramatically alter the shape and character of our schools, teaching practices, and curriculum (Bork, 1984). This marvel of the high tech era is the first major electronic innovation which has been pushed from society to the schools, from parent and student to teacher and principal. The driving force of the revolution is a relatively new and inexpensive computer of desk-top size which is referred to as a micro or personal computer to distinguish it from its larger and older counterparts.

Microcomputers as Instructional Aids

Microcomputers or personal computers have the capacity to handle several variables seemingly simultaneously; they can provide immediate feedback on answers; they can retrieve quickly large stores of information. Moreover, they have infinite patience.

With appropriate software, a microcomputer can perform such instructional operations as:

1. Address a student on a personal basis, referring periodically to individual characteristics.

2. Tell a student how well he or she performed in some instructional task.

3. Always say positive things or make positive suggestions, no matter how poorly a student performs.

4. Provide a different set of exercises to each individual student within a group.

5. Encourage a student to stay working at a task.

6. Keep accurate records of a student's activities, progress, and amount of time spent on various tasks.

7. Repeat directions and instructions as many times as an individual requires in order to learn something.

8. Be entertaining through the use of animation, sounds, and unexpected statements.

9. Encourage cooperative behavior and discourage competition among students by emphasizing criterion-referenced evaluation.

In short, microcomputers can become important electronic allies with teachers in the pursuit of social studies objectives. These technological tools already have demonstrated that they can capture student interest, provide instructional variety, and can serve as springboards to initiate study of a unit, among many other uses. Teachers need to become more aware of the scope and dimensions of the micro revolution, and its ramifications for all areas of formal education, including the social studies curriculum. They also need to examine models of how microcomputers may be applied to social studies instruction and incorporated naturally into the curriculum at both the elementary and secondary levels. The acquisition of such knowledge is frequently called "computer literacy."

The Nature of Computer Literacy

The term computer literacy, as it applies to teachers and students, has been the subject of much debate within the field of

computer education (Miller, 1984). No single definition is commonly accepted, although there are commonalities among the several contending notions (Luehrmann, 1980; Papert, 1980; Taylor, 1980; Morusund, 1980; Hunter, 1981-82; Seidel and Others, 1982; Radin and Greenberg, 1983). Morusund (1980) has suggested that a working definition of computer literacy is "A knowledge of the capabilities, limitations, applications, and possible effects of computers."

Perhaps the most authoritative definition proposed has been that of an Advisory Panel commissioned by the U. S. Department of Education (Computer Literacy, 1984). It noted that computer literacy "may be defined as whatever a person needs to know and do in order to function competently in our information-based society." The Panel went on to specify that computer literacy includes:

> "1. the ability to use and instruct computers to aid in learning, solving problems, and managing information;
>
> 2. knowledge of function, applications, capabilities, limitations, and social implications of computers and related technology; and
>
> 3. understanding needed to learn and evaluate new applications and social issues as they arise (Computer Literacy, 1984)."

At the least the term implies some awareness of the nature and applications of computers. At most it implies a proficiency

in one or more computer languages and in their several dialects. It has a broader meaning than the ability to operate microcomputers and programs already prepared and a narrower connotation than training as a computer programmer. It also suggests the capacity to create with a computer, as well as to act upon that which it presents. Computer literate individuals can use microcomputers to solve real problems which they have identified.

Developing Computer Literate Social Studies Teachers

Six dimensions of computer literacy for social studies teachers have been cited elsewhere as suggested components to be included in teacher education programs at both the preservice and inservice levels (Martorella, 1985a). They involve knowledge of the following:

1. basic sources of information
2. the process of communicating with microcomputers
3. hardware components
4. software and courseware
5. microcomputer applications in the social studies
6. social implications of microcomputers

Basic Sources of Information

There is a rapidly developing body of literature related to the microcomputer hardware and software industries and their applications. Not surprisingly, much of it is in the form of periodicals. Since developments in these areas are occurring at a dizzying speed, journals offer the most timely and effective

print vehicle for conveying information. An incredible number of new periodicals have sprung up over the past five years, and they continue to emerge. Their proliferation, evolution, and commercial success are themselves significant social phenomena for study.

Many are devoted to a specific brand of microcomputer, for example, Antic for ATARI users. Some are primarily concerned with software, and still others attempt to be all purpose journals. A selected sample of some of those all purpose periodicals which are not highly technical in nature and which should be of general interest to educators is provided below.

Creative Computing	Compute!
Classroom Computer Learning	Infoworld
Popular Computing	Electronic Learning

Periodicals such as these provide the most up-to-date source of new products, developments, and reviews of software and hardware in the area of microcomputers for teachers.

One of the most comprehensive sources of general information on microcomputers and related materials is the Directory of Educational Computing Resources, distributed annually by the publishers of Classroom Computer Learning, 19 Davis Drive, Belmont, CA 94002. It includes information such as the following:

Software sources

Hardware sources

Computer associations

Regional and national sources of teacher assistance

Calender of national and regional conferences

Communicating with Microcomputers

To communicate at all, humans and microcomputers require an interpreter. We would prefer to use our native language to communicate. The computer, on the other hand, understands only its own language, essentially sets of commands to turn sequences of electrical switches on and off. Through our learning a language which the interpreter understands, such as BASIC, communication is possible. An understanding of this process and an awareness of the nature and capabilities of various languages for communication with microcomputers (for example, PILOT, Pascal, FORTRAN, Ada, Logo, Forth, COBOL, or BASIC) provides some insight into the strengths and limitations of computers as instructional and managerial tools.

Programming and Communicating. Frequently computer literacy programs for teachers place an undue emphasis upon learning to program microcomputers, usually in a language such as BASIC, PILOT or Logo. Apart from those who wish to teach students how to program, neither today's generation of teachers nor the future one will ever have to learn to be programmers in order to communicate with or use effectively microcomputers in the classroom. Peter McWilliams (1982), who has written widely about computers, points out , for example, that "Learning BASIC, like learning any language is something some people take to and some people don't. It is unnecessary to the successful operation of a computer, and has nothing to so with the goal of computer literacy ."

Some first-hand experience in trying to communicate with a computer, however, is essential to appreciate the limitations of computers in communication. They require a high degree of literalness in what we tell them, and they have a very low tolerance for deviations from established communication rules. If a student types the sentence "The airpl ane flies in the sky," you know perfectly well what he or she is saying. You read six words, not seven, realizing that the space bar on the typewriter accidentally was hit, inserting a space between the letters l and a. The computer is not so tolerant, however. The presence or absence of a single space in violation of some syntactical rule, for example, may create a communications breakdown with a computer. A computer understands the command, PRINT "Hello" and related ones, but will balk at the request, PRIN T "Hello" because of the space between the N and T.

Computer Languages. BASIC is the most commonly used language today for communicating with microcomputers. All popular microcomputers have their own special dialects of these two languages. That is, there is a version of BASIC for an Apple, one for the TRS-80, and so on. All the dialects are similar, but each is sufficiently different so that one make of computer cannot understand another's dialect.

A language that has become increasingly popular in schools, especially for use with very young children, is Logo. Among its appealing features for children are that it permits objects to be drawn on the screen easily. Also, even a child can begin to write short programs with it after only a few instructions. Its

advocates maintain that it also encourages logical, structured thought, and that it encourages creativity.

With Logo, lines can be drawn from a point on the screen by giving instructions to an imaginery figure called a turtle. An example of a simple Logo program for drawing a figure is shown in Figure 1. It is written in the dialect called MIT Logo for an Apple II. Below the program a brief explanation is provided. Contrast the style of communications with the computer with those given in BASIC, as shown in Figure 2.

```
To Triangle
 ST
 REPEAT 3 [FD 10 RT 120]
 HT
END

TO PATTERN
  REPEAT 6 [TRIANGLE RT 60]
END
```

The meanings of the instructions are as follows:

1. Set up a drawing procedure to be called "TRIANGLE" (TO TRIANGLE).

2. Make the drawing of the lines visible or "show the turtle" (ST).

3. Do the following three times: draw a line forward 10 units and turn right 120 degrees (REPEAT 3 [FD 10 RT 120]).

4. This is the end of the procedure called "TRIANGLE" (END).

5. Set up a new procedure called "PATTERN" (TO PATTERN)

6. Do the following six times: carry out the procedure called "TRIANGLE" and turn right 60 degrees (REPEAT 6 [TRIANGLE RT 60]).

7. This is the end of the procedure called "PATTERN" (END).

Figure 1. Sample microcomputer program written in Logo.

Hardware Components

As I type this paper, several concrete computer components are in front of me. There is a monitor on which this writing is being displayed, a set of disk drives, a printer, and a detachable keyboard. The actual microprocessor or thumb-nail sized electronic chip, which makes all of the microcomputer activities possible is not a visible piece of hardware. It resides within the rectangular metal unit that houses the disk drives. Other microcomputer systems such, as those made by Radio Shack, ATARI, and Apple, integrate several or all of their basic hardware components into a single unit. These basic elements of typical computer configurations comprise a starting point for social studies teachers' functional understanding of hardware.

Computer Peripherals. Apart from alternative basic microcomputer hardware systems, there are a number of additional components or peripherals that may be attached to them for performing additional functions. Among the peripherals are the following:

Machines which will read coded cards or answer sheets for test scoring and analyses

Light pens and transparent television

monitor touch-screen overlays which permit responses to questions to be entered directly through contact with the screen rather than through keyboard entries

Graphics tablets where drawings such as maps may be entered directly into an instructional program through a sketch on a special tablet

Voice synthesizers whose capabilities permit spoken commands or hard-word-pronunciation enhancements to programs

Modems which allow easy communication between computers of all sizes, such as between a microcomputer and a large data-base computer

Videotape and videodisc machines which can add limitless amounts of visual material to instruction, under the control of either the teacher or the student

Software and Courseware

All of the applications of microcomputers to social studies instruction involve sets of communications or instructions to the computer to perform certain tasks. These communications in the special languages we have considered constitute the programs of instructions or the software which gives purpose and direction to the hardware. Courseware generally has a broader meaning than software. It refers to software which includes teacher plans,

supporting student activities, or some systematic combination of media.

The Availability Issue. In order to select software and courseware for instructional use in the social studies, teachers first need to identify where materials are available. Since educational software development is still in its infancy, many sources are still unknown to teachers. Currently, four basic sources of materials exist:

1. Materials which are not copyrighted and which are available at cost or for a nominal fee

2. Programs published in journals and books for copying and adaptation to different systems

3. Self-produced programs

4. Commercially produced materials

Three of the larger collections of software materials which are not copyrighted and which are distributed at cost or for a handling charge are maintained by:

Softswap, San Mateo County Office of Education, 333 Main Street, Redwood City, CA 94065

Apple Avocation Alliance, 721 Pike Street, Cheyene, WY 82009

Commodore Systems Division, 487 Devon Park Drive, Wayne, PA 19087

The third set of materials is distributed through Commodore dealers throughout the United States, and includes programs in history and geography.

Various materials which are not copyrighted or which are self-made tend to be a mixed bag. The creation of exceptional software is a time consuming, complex task requiring individuals skilled in programming and in the capabilities of various hardware systems. Consequently, when individuals are able to develop such materials, they often decide to market them commercially.

Not all commercial software is exceptional, however, and teachers need to examine all software as critically as they do traditional print materials and media. They need to become conversant with the capabilities and limitations of existing software, and to learn how to evaluate such materials according to objective criteria (Otte, 1984). A useful set of criteria and a simple easy-to-use evaluation format, Evaluator's Guide for Microcomputer-Based Instructional Materials, has been developed by the International Council for Computers in Education, University of Oregon, Eugene, OR, 97403.

In the past it has been difficult for teachers even to obtain examination or review copies of commercial software from publishers, who feared, with some justification, that expensive software would be copied and then returned. There are signs that this policy is changing. Increasingly, publishers are developing strategies to safeguard against copying and to expedite reviewing. Several major companies, such as Scholastic, Inc., now offer educators the opportunity to examine materials and then return them within a 30 day period.

The Compatability Issue. Since the finest of hardware systems are useless for instruction without some software, either commercially or individually produced, it is often suggested that educators first seek the software they need before purchasing hardware. This common suggestion results in part from the fact that software designed for one hardware system, say an Apple IIe, is not compatible with or will not operate on another such as an ATARI 800. There are signs that this compatibility issue may be resolved in the future, but for now it is a major consideration in selecting software.

Where the school already has purchased computer systems, educators need to be certain that the software identified is will function properly with the available hardware. In addressing the compatability question and in determining whether software will operate on the school's microcomputer system, educators need to ask three basic questions about the software:

1. For which type and model of computer is it designed (i. e., Apple II+, TRS-80, Model IV, etc.)?

2. How much memory must our computer system have to operate the software?

3. Besides the microcomputer and television or monitor, what other peripherals, if any, are necessary to use the software fully (e. g., one or more disk drives, printer, etc.)?

Microcomputer Applications in the Social Studies

As an instructional tool, computers can aid the teacher in achieving more adequately, efficiently, or economically various objectives laid out in the curriculum. In this role computers are

used, as are other tools, only when needed for an appropriate educational task. Personal computers serve as electronic extensions of the teacher, much like an overhead projector. The instructional aim is not to use the computer, but rather to accomplish some curricular objective for which the computer is a suitable tool.

The information educators receive today concerning how microcomputers and software can aid them in teaching social studies is not likely to satisfy them, though it should whet their appetites. The major point of concern is not the relative number or quality of the current materials, although this is certainly a serious one (Ott, 1984). The larger problem is the limited extent to which software and courseware seriously address the total scope and sequence of the typical social studies curriculum.

An assortment of programs with individual lessons, exercises, and activities - some of them stimulating and thought provoking - do exist for most popular microcomputers. However, there is little software available which addresses the wide range of objectives associated with the scope and sequence of a typical K - 12 social studies curriculum. The findings from two recent general surveys of software available for the social studies underscore this point (Cohen, 1982; Hodges, 1982).

Several basic generalizations are possible concerning the software currently available in social studies.

1. Although a number of programs exist which teach students to develop and test hypotheses, to generalize, to engage in problem solving, and to develop research, analysis,

spatial, and social skills, the majority are designed to teach specific sets of facts.

2. Among the various areas of the social sciences represented in the software choices, history, political science, economics, and geography are dominant.

3. No materials exist to teach specific social science concepts.

4. Even the most unimaginative of programs provide some degree of individualization of instruction.

General Applications. Given the limitations of existing software discussed, there are a number of different ways in which the current generation of microcomputers can be used to enhance social studies instruction or to ease the burdens of teachers (Cohen, 1982; Diem, 1981; Robinson, 1982; Rothman, 1982). Some are potentially more valuable at the elementary levels, while others would be meaningful only for older students. All of the applications discussed, regardless of their relative individual merits, represent activities in which social studies teachers and their students are typically engaged.

As a tool for psychological experiments, a personal computer can present scales, surveys, or stimulus material, accept individual anonymous or identified responses, and tabulate the data from the experiment (Johnson, 1982; Heise, 1982). It is also an ideal tool for those areas of the social studies which involve some aspects of data retrieval, analysis, organization, and presentation (Rowney, 1982). Even the most inexpensive personal computer today can be linked via telephone to a series of large

commercial data bases which can supply literature searches, news reports, encyclopedia entries, and an assortment of other types of information. On a limited basis, some public institutions such as universities permit schools to have access to statistical programs and other data tools. One social studies class in the Shoreham-Wading School District in New York under the direction of Herb Meserve, for example, used the SPSS statistical programs of a nearby university via telephone hook-up to analyze survey data which high school students had collected for a project (Meserve, 1981). Listings of the many national data banks which educators can use are available in several published works (Cuadra, 1982; Glossbrenner, 1983).

Sample Software for the Social Studies. A complete listing of all software currently available in the area of social studies for elementary, middle, and senior high school students is beyond the scope of this paper. Some examples of programs are briefly discussed below, however, to illustrate the variety of objectives that existing software can address.

Processing and Interpreting Data. The computer is an ideal tool for those areas of the social studies which involve some aspects of data retrieval, analysis, organization, and processing (Rowney, 1982). Organization of data into such forms as tables, pie charts and bar graphs for easy visualization is often a useful way to summarize large bodies of statistical data. A number of commercial programs make this transformation an easy task, and produce attractive color displays very quickly.

Examples of well-designed programs which allow students to easily process and translate raw data into forms such as a pie graphs, bar graphs, and charts is Graph It by ATARI and Data-Plot from Muse Software. General data-base and filing programs also may be used to develop "what-if" scenarios and data files for analysis and generalizations in secondary classes (Martorella, 1984a; 1984b).

Communication Skills. A variety of word processing programs have been developed for encouraging students to write reports or do projects. Basically, word processing programs take some of the tedium out of writing and rewriting. They also make corrections easy, and they encourage editing and experimentation (McWilliams, 1982). A variety of spelling checker programs will examine the writing for spelling errors. Programs such as Punctuation and Style also can check a document for improper word usage, jargon, sexist terms, repetitious use of words, some punctuation errors, and some improper capitalization.

One of the easiest word processing programs to use currently is Bank Street Writer, produced both by Broderbund Software and Scholastic, Inc. It was designed for children and is appropriate for use in the intermediate and middle school grades. A number of other similar programs are being marketed or are under development.

Group Participation Skills. Any instructor who has observed students in a programming class working on microcomputers will attest to the spontaneous task-oriented, cooperative social behavior that often arises when a student needs help. As one

researcher has noted, "I have seen more collaborative, cooperative, problem-solving among kids who are doing program activities together than anywhere else in schools (Bracey, 1982, p.54)."

Computer simulations in particular provide an excellent evehicle for improving group participation skills. While simulations often assume only one user per computer, anecdotal data suggest that they seem to encourage cooperative behavior when a small group is assigned to the game. President Elect by Strategic Simulations, which simulates the operation of the Electoral College, is an exceptional example of a simulation that exploits the capacity of microcomputers to analyze a number of variables, to incorporate subject matter related graphics, and to retrieve stores of information as needed (Martorella, 1984c). The simulation is both an effective learning device and a catalyst for cooperative behavior when played by a group, rather than an individual.

Facts. Probably more computer materials exist to teach facts such as names of capitals and states or countries or provinces, lists of presidents, collections of dates, names of continents and oceans, and other such lists than any other objective. Many of these types of programs are classified as "drill and practice," since they emphasize memorization through repetion. The worst are merely electronic workbooks. The more interesting of these programs employ graphics, sound, audio instructions, and immediate feedback on responses and percentages of correct answers. Some of the better designed and more colorful of these

are Atlas of Canada and European Countries and Capitals by ATARI and the Game of the States by Milton Bradley.

The fundamental programming structure of this type of instructional material, apart from the inclusion of graphics, often is relatively simple. Designing a small program to teach such material is a suitable project for social studies teachers who are interested in experimenting with hands-on programming in BASIC. Figure 2 provides an example of a very simple program which requires very little programming ability and time to construct, and which uses humor to stimulate interest in a general area.

```
10 INPUT "What's your name"; Y$
20 INPUT "Who's your favorite President"; F$
30  INPUT "Pick just one word that says something about  what
you would like to do to the President"; V$
40 PRINT "I'm going to tell you a story about "; F$
50 PRINT "Once upon a time, President "; F$
60 PRINT "Had a young admirer named "; Y$
70 PRINT Y$; " wished to "; V$; " "; F$
80 PRINT "Interestingly, "; F$; " also wanted to "; V$; " "; Y$
90 PRINT "Will "; Y$; " "; V$; " "; F$
100 PRINT "Will "; F$; " "; V$; " "; Y$
110  PRINT  "The  world awaits the  outcome of  the  meeting
between "; Y$; " and "; F$
```

A sample run of the program might look like the following; answers which a student might type in are

underlined:

What's your name? Jake

Who's your favorite President, Jake? Franklin Pierce

Pick just one word that says something about what you would like to do to the President? tickle

I'm going to tell you a story about Franklin Pierce

Once upon a time, President Franklin Pierce

Had a young admirer named Jake

Jake wished to tickle Franklin Pierce

Interestingly, Franklin Pierce also wanted to tickle Jake

Will Jake tickle Franklin Pierce

Will Franklin Pierce tickle Jake

The world awaits the outcome of the meeting between Jake and Franklin Pierce

Figure 2. Sample microcomputer program written in BASIC.

Concepts. While no computer materials currently exist to teach social studies concepts, computers have the capacity to handle the task more effectively than any other instructional tool (Gagné and Others, 1981; Martorella, 1971). The program Mortown Parade, produced by The Learning Company for young children, helps develop more efficient concept learning strategies in general. In essence materials for teaching concepts require varied, well defined sets of examples and nonexamples of the concepts, along with directions and questions (Martorella, 1985b). Project ComICon at Temple University, supported by the

ATARI Institute and directed by the author, currently is developing prototype materials to illustrate how teachers may design computer programs to teach any concepts.

Problem Solving. A number of computer simulation games have been designed to encourage problem solving and cooperative behavior in the context of pursuing geography, history, political science, anthropology, economics, and sociology subject-matter topics (Cohen, 1982; Copeland, 1984; White, 1984). One of the more detailed and colorful sets of simulation materials is The Search Series by McGraw-Hill. It includes five topics which range from an ancient navigator expedition to an archeological dig. Another example is the Snooper Troops series developed by Spinnaker Software Inc., which develops deductive logic skills and problem solving in children in the intermediate and middle grades. For preschool and primary children, Gertrude's Secret and Rocky's Boots by The Learning Company are designed to achieve the same objectives. Historian, currently under development holds the promise of also being an effective new problem-solving program (Copeland, 1984).

Management of Classroom Tasks. Apart from aiding teachers with instructional tasks, there are a number of ways in which microcomputers can help teachers manage some of their general professional responsibilities (Pogrow, 1982a; 1982b). As examples, the areas in which they can aid include the following:

preparing written materials

general record keeping

filing records and general information

assessing the reading levels of materials

Commercial programs exist to assist in all of these tasks, and some even have been published in journals for copying. Just a few examples of them are Finding Readability Levels by Sunburst Communications to assess reading levels, Grade Book Disk by Southeastern Educational Software to keep class records and student averages, and PFS:File by Software Publishing Corporation to develop and retrieve files easily.

Software Development in the Future. The future task of developing successful, comprehensive K - 12 social studies curriculum software will require the joint efforts of educators, subject matter specialists, and computer personnel. This should occur in much the same way that teams of specialists have combined effectively to produce quality curriculum products in the print media. Ultimately, unless the social studies software being produced meets a substantial number of significant curricular objectives, personal computers are not likely to be regarded as an important tool by social studies educators. Moreover, once its novelty effect wears off, even appropriate software increasingly will be expected to demonstrate that it can help teachers and administrators meet their objectives more effectively or efficiently than alternate tools.

Social Implications of Microcomputers

The political, social, and economic consequences of the micro revolution, as well as its fascinating history and geographical dispersion, should be the province of the social

studies class. The rapid growth of data banks and computer networking and the relative ease with which proprietary materials may be copied have created serious ethical and legal issues for society which students need to address, just as they should consider other urgent contemporary value questions.

Just a few of the topics which may be examined include:

How each of us feels about the rise of computers

The role that computers can and should play in our society

The fears and anxieties that computers produce in many people

The real and imagined potential of computers for dehumanization

What a computerized society of the future will be like

Conclusion

The preceding discussion has identified six dimensions of computer literacy for social studies educators to address. In preparing social studies teachers for the 21st Century they need to determine which aspects of literacy are essential to incorporate into their specialized teacher education components. This is crucial if the profession is to appropriately prepare teachers to use new technologies, to have an active role in school computer education programs, and to insure that the social studies curriculum fully exploits computer technologies and addresses their human costs and benefits.

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